

REMARKS:

Claims 1-3, 5-6, 9-10, 12-17 and 19 are pending in the present application.

Applicants appreciate the Examiner's thorough examination of the application. In the Office Action dated August 8, 2005, the Examiner initially rejected all pending claims pursuant to 35 U.S.C. § 102 and/or 35 U.S.C. § 103 as being anticipated by or obvious in view of one or more of the following references – U.S. Patent No. 5,820,246 issued to Helstern et al.; U.S. Patent Publication No. 2004/0012956 to Chen; and U.S. Patent No. 6,592,238 issued to Cleaver et al. Before discussing these rejections of the claims of the present application, Applicant believes it to be beneficial to review the essential features and advantages of the present invention in order to place the discussion of the claims in proper context.

The present invention is an illumination device that is an effective simulator of neon and/or fluorescent lighting in that it provides for an essentially uniform light intensity distribution pattern over a lateral, light-emitting surface, but equally important, the illumination device can be produced in a cost-effective manner because the amount of light-scattering compound used to produce the device of the present invention is reduced as compared to prior art devices.

To accomplish this, an illumination device made in accordance with the present invention includes an optical waveguide that is interposed between a light source (i.e., a multiplicity of point light sources, such as light-emitting diodes) and a scattering cap. The optical waveguide has an elongated rod shape to mimic the appearance of a neon or fluorescent light. More importantly, the waveguide is capable of efficiently transmitting light entering the waveguide in a preferential direction, preferably through a process known as total internal reflection (TIR).

Theoretically, TIR directs light more efficiently than any known reflective surface; for example, directing light using an optical waveguide is more efficient than reflecting light off white walls. Specifically, TIR is the reflection of the total amount of incident light at a boundary, such as the boundary between the side surfaces of the waveguide and air. TIR is possible when the light is in the more dense medium (i.e., the waveguide) and is approaching the less dense medium (i.e., air). Then, assuming the light source is oriented such that the angle of incidence of light at the waveguide-air boundary is greater than a predetermined critical angle, all light will be reflected, and there will be no refraction. Accordingly, light entering the waveguide is efficiently directed into the scattering cap, the light scattering properties of this component causing it to uniformly glow over its lateral surface.

In reviewing the cited prior art references, U.S. Patent No. 5,820,246 issued to Helstern et al. describes and claims a display system, which is "particularly advantageous when used in association with controls for a vehicle, such as an aircraft." See column 2, lines 34-36. This display device does include light-emitting diodes as the light source, but does not have a structure for simulating neon or fluorescent lighting. Rather, the light emitting diodes "are enclosed in a rectangular housing 56." See column 3, lines 58-59. Finally, although the Examiner has asserted that Helstern describes transmission of light through total internal reflection, Applicant can locate no such teaching in this reference.

U.S. Patent Publication No. 2004/0012956 to Chen describes a "lamp strip" that includes a plurality of light-emitting diodes, each received in a bore defined in a light bar. However, this light bar is simply a flexible, transparent length of plastic material. There is no indication that it serves as an optical waveguide, transmitting light in a preferential direction. Furthermore,

although the Examiner has asserted that Chen also describes transmission of light through total internal reflection, Applicant can locate no such teaching in this reference.

Finally, U.S. Patent No. 6,592,238 is a patent that Applicant is well aware of, since this particular patent and the present application were prosecuted by and assigned to the same entity. Indeed, the present application includes a detailed description of this prior art reference, noting that the "leaky waveguide" described in the reference require a compound with certain physical attributes, which results in a compound that is not inexpensive. Accordingly, it is an object of the present invention to provide an improved illumination device that serves as an alternative to neon lighting with all the benefits of devices made from known compounds having desired light scattering properties needed to produce a leaky waveguide, but with the additional benefit of reduced expense. In any event, although Cleaver does describe certain constructions of an illumination device that include an intermediate spacer 48 (Figure 9A) or a potting compound 52 (Figure 9C), these are not optical waveguides transmitting light through total internal reflection. Quite to the contrary, as the Examiner notes, "[s]uch spacer 48 could be fabricated from the same material as the waveguide 12, e.g., a high impact resistant acrylic material." See column 8, lines 34-36. However, this material is the "leaky waveguide" compound mentioned above; it is the express objective of the present application to minimize the use of such a compound through the use of an intermediate waveguide.

Referring now to the claims of the present application, claim 1 has been amended to clarify the shape and structure of the illumination device, reciting that the optical waveguide has an "elongated rod shape." Furthermore, claim 1 now clarifies that the light source is a "multiplicity of spaced point light sources positioned adjacent to and arranged in a line extending

along the light-receiving surface of said waveguide....” Such a construction is clearly neither taught nor suggested by Helstern.

Finally, claim 1 recites that light is transmitted through the waveguide through total internal reflection. As discussed above, none of the cited prior art references describe or teach transmission of light through an optical waveguide through total internal reflection prior to the scattering of the light by a scattering cap to create a substantially uniform light intensity pattern. Of course, it is well settled that for a rejection to stand, “the prior art references (or references when combined) must teach or suggest all of the claims limitations.” M.P.E.P. § 706.02(j) (emphasis added).

For these reasons, Applicant respectfully submits that claim 1 is now in condition for allowance. Claims 2-3, 5-6, and 9-15 depend from claim 1, and therefore, are also now each believed to be in condition for allowance.

Claim 16 is the second independent claim of the present application, a claim that was initially rejected only in view of the Helstern and Cleaver references. Claim 16 has also been amended to clarify the shape and structure of the illumination device, reciting that the optical waveguide has an “elongated rod shape” and that the light source is a “multiplicity of spaced point light sources positioned adjacent to and arranged in a line extending along the light-receiving surface of said waveguide....”

Furthermore, and perhaps more importantly, claim 16 also recites a “a protective shield applied to and encapsulating the waveguide, housing, and scattering cap.” No such element is described or suggested in the cited prior art references for encapsulating the complete assembly of the elongated, rod-shaped waveguide, housing, and scattering cap. Specifically, and as

described above, Helstern fails to teach or suggest a construction that includes a elongated, rod-shaped waveguide, housing, and scattering cap. As for the Cleaver reference, although the Examiner makes a general statement that claim 16 is anticipated by Cleaver, the Examiner does not point out or identify any element or structural feature that can be characterized as "a protective shield."

For these reasons, Applicant respectfully submits that claim 16 is now in condition for allowance. Claim 17 depends from claim 16, and therefore, is also now each believed to be in condition for allowance.

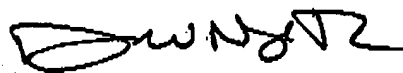
Claim 19 is the third and final independent claim of the present application, a claim that was also initially rejected only in view of the Helstern and Cleaver references. Claim 19 has also been amended to clarify the shape and structure of the illumination device, reciting that the optical waveguide has an "elongated rod shape" and that the light source is a "multiplicity of spaced point light sources positioned adjacent to and arranged in a line extending along the light-receiving surface of said waveguide...."

Furthermore, and perhaps more importantly, claim 19 also recites a "protective sleeve that encases the entire illumination device, except for the lateral surface of the scattering cap." Again, no such element is described or suggested in the cited prior art references for encapsulating the complete assembly of the elongated, rod-shaped waveguide, housing, and scattering cap. Specifically, and as described above, Helstern fails to teach or suggest a construction that includes a elongated, rod-shaped waveguide, housing, and scattering cap. Additionally, in Helstern, the housing 56 that the Examiner characterizes as a "protective sleeve" includes a display panel 46 that fits over and enclose the optical device 22. In other words, this

housing/protective sleeve does not leave visible the "lateral surface of the scattering cap" as required by claim 19. As for the Cleaver reference, although the Examiner makes a general statement that claim 19 (like claim 16) is anticipated by Cleaver, the Examiner does not point out or identify any element or structural feature that can be characterized as "a protective shield."

For these reasons, Applicant respectfully submits that claim 19 is now in condition for allowance.

Respectfully submitted,



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